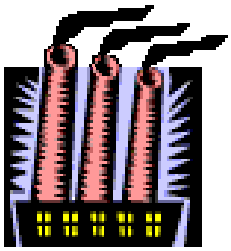
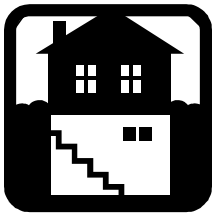
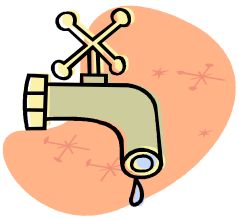


Air Quality & Asthma



Radon & Lung Cancer



Arsenic & Skin Cancer

Database Inventory Report for Priority Environmental Health Issues in New Hampshire

Version 1.0

New Hampshire
Environmental Health Tracking Program

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Preface

*"**Public Health Surveillance** is the ongoing, systematic collection, analysis, and interpretation of outcome-specific data (illness and health) used to plan, implement, and evaluate public health practice."*

Common sense and historical experience have taught us that environmental conditions such as clean water, fresh air, safe food and clean buildings are closely related to human health, but rarely do we track these two factors together unless there is an acute disease outbreak or epidemic. The public health success of sanitation in food establishments, purification of public drinking water, management of wastes, and occupational health codes have reduced environmental illness drastically in the developed world. With success often comes complacency, and our society has rested on the laurels of reduced deaths and standardized protection for known illnesses. Yet, there are many environmental exposures that do not result in acute illness or rapid death, rather, low levels of pollutants can cause slow, silent illnesses such as lead poisoning, or complex chronic diseases such as asthma, allergy, cancer, or neurobehavioral problems.

Improved environmental monitoring and disease surveillance often reveals the subtle associations between the two interactive realms of pollution and people. Currently, few systems exist at the state or national level to track the exposures and health effects that may be related to environmental hazards. While we have developed excellent infectious and chronic disease tracking systems, the more complex world of environmental illnesses has been left to one-time studies and risk management. Because existing systems are not linked, it is difficult to study and monitor relationships among hazards, exposures, and health effects.

In January 2001, the Pew Environmental Health Commission called for the creation of a coordinated public health system to prevent disease in the United States by tracking and combating environmental health threats. (Pew Commission 2001) In response, the United States Congress appropriated funding to the Centers for Disease Control and Prevention (CDC) in Fiscal Year (FY) 2002. This funding enabled the development of CDC's National Environmental Public Health Tracking (EPHT) Program, which is led by the National Center for Environmental Health's (NCEH) Environmental Health Tracking Branch (EHTB). The purpose of the national EPHT Program (the Program) is to provide information from a nationwide network of integrated health and environmental data that drives actions to improve the health of communities. This National Network (the Network)

will integrate three distinct components: hazard monitoring, exposure surveillance, and health effects surveillance. CDC's EHTB is establishing the Network by drawing on a wide range of expertise from federal agencies, state and local health and environmental agencies, non-governmental organizations (NGOs), state public health and environmental laboratories, and the Program's Academic partners in Schools of Public Health. Data from this Program can be used to identify areas and populations most likely to be affected by environmental contamination and to provide important information on the health and environmental status of communities. The Network will provide valuable data on trends that can be used to study the possible relations between the environment and noninfectious health effects. The data can be used to drive public health policy and actions that ultimately will reduce the burden of adverse health effects on the American public.[1]

The success of the Network relies on the development of a two-tiered information infrastructure whereby state environmental health tracking programs essentially feed state data to the Network. Therefore, the importance of developing an effective data identification and exchange system at the state level cannot be understated. The creation and maintenance of such a system is a multi-part process involving the cooperation of multiple agencies, programs and personnel beginning with the identification of priority areas of investigation and the inventorying of existing databases for the assessment of data, data access, data management and eventual linkage of respective information technology (IT) systems regarding those areas.

This document, ***Database Inventory Report for Priority Environmental Health Issues in New Hampshire,*** provides a description of New Hampshire's efforts regarding the creation of an inventory and comprehensive assessment of the databases housed in the NH Department of Health and Human Services and the Department of Environmental Services that collect health and environmental data related to the priority areas of air quality and asthma, radon in household air and lung cancer, and arsenic in public drinking water and bladder and skin cancer. In addition, it summarizes the current IT infrastructure and architecture of those two agencies, the administration and operation of their IT infrastructure, and the interaction between those agencies and local health departments in regard to IT.

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1. *CDC's Strategy for the National Environmental Public Health Tracking Program.* Fiscal Years 2005-2010, www.cdc.gov/nceh/tracking/pdfs/strategy.pdf
2. *America's Environmental Health Gap: Why the Country Needs a Nationwide Health Tracking Network*. Pew Environmental Health Commission 2001, www.cdc.gov/nceh/tracking/background.htm

Executive Summary

This report fulfills an agreement between New Hampshire and the CDC to develop a comprehensive inventory of existing hazard and exposure monitoring and non-infectious health effect surveillance systems maintained at the state and local level for asthma, cancer, and related environmental exposures (see Cooperative agreement #02179, Recipient Activity 1, Part A, 2). The report fulfills the following tasks:

(a) Describe the purpose and operation of the system and the resources used to operate the system as discussed in CDC's *Updated Guidelines for Evaluating Public Health Surveillance Systems* (Internet address for this document is listed in Appendix II) and refer to *Appendix IV for Guidance for Preliminary Inventory and Future Assessment of Health Surveillance and Environmental Monitoring Information Systems*.

(b) Describe how these systems have been used to affect public health action and policy.

(c) Evaluate existing organization, personnel, and technical infrastructure against CDC's Public Health Information Technology Functions and Specifications (for Emergency Preparedness and Bioterrorism) and NEDSS and EPA National Environmental Information Exchange Network architecture and specifications, and identify issues to be addressed for integrating/linking data and establishing the Environmental Public Health Tracking (surveillance) Network.

Specifically, this report provides a review of selected environmental and health databases that are available in the State of New Hampshire in mid 2005, with a special focus on the important issues of asthma and cancer. This document is titled **'Database Inventory Report for Priority Environmental and Health Issues in New Hampshire, Version 1.0'** in order to emphasize the flexible and expanding nature of electronic information. The purpose of this report is to provide both researchers and decision makers with a tool to find and use better information. The report presents four analyses: 1) a background on the need for this inventory, 2) a gap analysis of existing data, 3) an overview of the available data, and 4) an accounting for the data fields (metadata) available from each source, and so provides one of the building blocks for better data collection and analysis. The lessons learned from this report will be applied toward addressing public health problems, such as asthma and cancer, which are highly relevant to our citizens, expensive to treat, and have a significant environmental component.

I. Introduction

A. Choosing Priority Areas of Investigation

For the past 15 years, New Hampshire has been ranked as one of the top two healthiest states in the nation. A number of factors contribute to this health status, including an older population with higher average income, better education, and possibly a culture of higher physical activity. Yet even the healthiest of locations have sub-populations that experience negative health outcomes related to the environment. For example, rates of childhood asthma are higher in New Hampshire than the national average, and the number of new cases of cancer in men and women per 100,000 is also higher than the national average (*http://healthyamericans.org/state/index.php?StateID=NH*). New Hampshire also grapples with natural environmental hazards due to its geologic heritage, such as high levels of radon gas in bedrock and soils that collect in our homes. In addition, the geology also leads to higher levels of the heavy metal arsenic in ground water for the large proportion of citizens who rely on private wells for drinking water.

In order to prioritize the most important environmental health issues facing New Hampshire, the NH EHT Program reviewed current and past assessments of environmental health risks and concerns. We are fortunate that many of these projects use measurable indicators and evidence-based practices to rank the most important public health issues. These stakeholder processes include: the *1998 Report of Ranked Environmental Risks in New Hampshire, Healthy New Hampshire 2010,* the *Turning Point Project,* and the legislative *Commission to Study the Relationship between Public Health and the Environment*. A number of common environmental health issues were identified in these assessments and are presented in Table 1. In order to simplify the grouping of priorities the table is divided into categories of environmental hazards, health effects, and infrastructure. The priority environmental health areas selected by the EHT Program are highlighted in yellow.

Table 1. A Comparison of Environmental Health Priorities in New Hampshire, 1998-2004

Environmental Health Issue	NH Comparative Risk Report, 1998	Healthy NH 2010 Project (2001)	Legislative Commission, 2002	EHT Advisory Council, 2004
Hazards/Pollutants				
Arsenic (in Drinking Water)	X	X		X
Radon (in Water & Indoor Air)		X		
Airborne Dust (Particulate Matter)	X	X		
Indoor Tobacco Smoke (ETS)	X	X		X
Sun Over-exposure (UV Radiation)	X			
Ingested Lead	X	X		X
Allergens (Indoors & Outdoors)	X			
Smog/Ground Level Ozone	X	X		
Pesticides/Organ chlorines	X			
POPs (Persistent Organic Pollutant)				X
Dioxin (Persistent chlorines)				
Fuel Contaminants (MTBE, etc.)				
Noise				
Toxics and Waste				
Food Contamination (Food borne Disease)	X			
Water Contamination (Waterborne Disease, surface and drinking)	X			X
Health Effects				
Asthma (environmental triggers)	X	X		X
Lung Cancer				
Skin Cancer				
Birth Defects				
Developmental Disabilities				
Acute Poisonings/Chemical spills				
Heavy Metal Poisonings (mercury, etc)				
Carbon Monoxide Poisoning				
Sentinel Events (disease clusters, disasters, etc.)				
Heat/Cold Injuries				
Infrastructure				
Environ. Health Surveillance		X	X	X
Indoor Environmental Standards		X	X	
Environ. Health Infrastructure			X	X
Strategic Environ. Planning and Communication			X	
Biomonitoring of Human Tissue			X	
Excluded Issues				
Occupational Health Issues				
Tobacco & Smoking				
Diet & Physical Activity				

In these risk assessments, asthma and air quality ranked consistently high on the list of concerns identified through these stakeholder projects. Asthma was ranked high by three of the stakeholder groups, while indoor air quality, outdoor air quality, and environmental tobacco smoke were also ranked high. Arsenic in drinking water was also ranked high by stakeholders, although cancers of the bladder and skin were not indicated as a high concern. Only one stakeholder group identified radon in homes as a priority, and lung cancer was not mentioned. Three stakeholder groups identified lead poisoning as a high priority, although related developmental disabilities or non-behavioral problems were not ranked high.

Taking into account that in some cases nearly 10 years had passed since the evaluative process leading up to the publication of these reports, the NH EHT Program conducted further research regarding these concerns before selecting priority areas of investigation for the development of an environmental health tracking system. This research included an analysis of the epidemiological impacts of these risks on the citizens of New Hampshire and a general review of the quantity and quality of available data regarding those risks. Given that information, the NH EHT Program chose to pursue the following priority areas:

- Asthma and Air Quality (both indoor and outdoor)
- Lung Cancer and Radon in Homes
- Bladder/skin Cancer and Arsenic in Drinking Water

The following narratives provide a summary of the research conducted by the EHT Program regarding these three areas.

B. Background on Three Priority Environmental Health Issues

1. Air Quality & Asthma in New Hampshire

Asthma is the most prevalent disease among children in the US and the leading cause of lost school days. The New Hampshire Environmental Health Tracking Program (EHTP) has selected asthma as a priority issue for three main reasons: 1) the self-reported lifetime prevalence of asthma in the US in 2002 was estimated to be 30.8 million[1]; 2) in 2002, 13.9% of adults in NH reported a diagnosis of asthma in their lifetime2; and 3) there are disparities in the prevalence and severity of asthma between genders and among age groups and racial and ethnic groups. [3]

Asthma affects a growing number of people in New Hampshire. According to 2002 BRFSS survey data, approximately 14% of New Hampshire adults (or 83,000 people) reported they had been told "sometime during their life" that they had asthma. 8.7% reported they still had asthma. [4] In 2001

there were over 6,000 asthma-related emergency room visits by New Hampshire residents, which incurred approximately $3 million in total charges. Individuals age 15 to 34 had the highest rate of asthma-related emergency room visits that year.[4] In 2001 there were 752 asthma-related hospitalizations, which resulted in 2,412 days spent in the hospital and total charges of $4.2 million. Children under the age of 5 and adults aged 65 or older had the highest rates of hospitalization for asthma.[4] The asthma hospitalization rate among females was approximately two times higher than the rate among males each year from 1996-2001. Females also had higher rates of emergency department visits and death due to asthma during this period.[4] Asthma is an ideal target for public health intervention as asthma attacks can be controlled through early case identification, medication, and the control of environmental triggers.

Air pollution is a known environmental trigger for asthma attacks and many studies have linked the incidence of asthma attacks to both indoor and outdoor air quality. [5,6,9,11,12] Some of the most compelling evidence relating outdoor air quality to asthma morbidity came out of studies set in Atlanta, GA during the 1996 Summer Olympic Games. Decreases in traffic density in the down-town area during the Olympic Games was found to be associated with decreases in ozone pollution and significantly lower rates of asthma hospitalizations and ED visits.[11] In a multi-city study looking at environmental control of indoor asthma triggers, the study group received educational interventions and trainings on how to control their particular triggers. A significant reduction in both the presence of the asthma triggers and asthma morbidity was seen in the study group as compared with the control group, where no interventions were carried out.[9]

Asthma and its relation to air quality has been prioritized as top environmental health issues in New Hampshire by several advisory and community groups, including the NH Comparative Risk Project in 2002, the legislative Commission to Study the Relationship Between Public Health and the Environment, and Healthy NH 2010. The NH Comparative Risk Project resulted in a ranked list of environmental risks in New Hampshire in 1998 based on the "blended judgment" of 55 members of a Public Advisory Group. Particulate matter was ranked as the #2 environmental exposure of concern in NH, due in part to the public health impact on people with existing lung disease.

The NH legislative Commission to Study the Relationship Between Public Health and the Environment spent two years (2000-2002) evaluating the science of public health and the environment by listening to testimony and reviewing written material in order to report on the current state of environmental health in NH and provide recommendations for improvement. Asthma was identified as an issue of concern and the Commission heard testimony on this topic in January of 2002 and made

a recommendation to "study how indoor and outdoor air quality issues can be better linked, addressed and regulated."[7]

Healthy New Hampshire 2010 is another prioritization process that was introduced in March of 2001 as a disease prevention and health promotion agenda for the state. It was created through a collaboration of health professionals, advocates, educators and policy makers. The following HNH2010 objectives relate to asthma and air quality: reduce hospitalizations for pediatric asthma (per 10,000 population age 0 through 17 years), increase the percentage of newly constructed and renovated buildings that are professionally designed to meet established air quality standards, decrease the number of emissions that exceed the National Ambient Air Quality Standard.[8] In addition, New Hampshire DHHS applied for and received an Asthma Control grant from the Centers of Disease Control and Prevention in October of 2001 and has used that funding to establish a statewide Asthma Control Program.

2. Radon in Homes & Lung Cancer in New Hampshire

Radon is the second leading cause of lung cancer in the United States. The NH EHTP has selected radon and lung cancer as a priority issue for three main reasons: 1) NH lung cancer rates are consistently at or above the national average; 2) NH's potential for radon exposure is higher than the national average; and 3) exposure to unhealthy levels of radon is preventable.

Radon is a naturally occurring radioactive gas that seeps out of rocks and soils. It becomes a hazard to human health when it accumulates in high concentrations in indoor air. Radon is the second-leading cause of lung cancer after smoking. As the leading environmental cause of lung cancer, indoor air radon is estimated to be a causal agent in 10% to14% of all lung cancer deaths in the US. Most of these deaths are among smokers, due to the dangerous interaction of smoking and radon exposure. Radon also represents a health risk to non-smokers. Among the 11,000 lung cancer deaths to non-smokers in the US each year, between 2100 and 2900 are estimated to be radon-related (NRC, 1999).

Estimates of radon exposure potential in NH identify Carroll County as a radon "hot spot" in the northeast corner of the state.[13] The three counties of secondary concern in NH are Coos, Rockingham, and Strafford. Parts of Hillsborough County also exhibit elevated radon exposure potential. It is important to emphasize that *all* towns in *every* county have some homes with high levels of radon. While knowing geographical risk is helpful, the only way to know if a particular home has a high indoor radon concentration is to test the indoor air.

Lung cancer is the leading cause of cancer death in both men and women in New Hampshire and the nation. New Hampshire's lung cancer rates have historically been at or above the national average for the white population (NCI, 2005). Lung cancer mortality for NH males was significantly elevated in the 1970s and early 1980s before converging on that of US whites (NCI, 2005) .[14] The most recent State cancer report shows NH male lung cancer incidence to be significantly higher than that of US whites, while mortality is about the same as the national rate .[16] NH female lung cancer mortality followed the US white trend very closely until the mid-1980s when it increased to a level significantly higher than the national average.[14] Both incidence and mortality rates for NH females have remained significantly elevated in recent years.[16]

Exposure to unhealthy levels of radon is preventable through mitigation in cases where test results exceed recommended standards. Estimates derived from the NH BRFSS and the NH Radon database suggest that as few as one-third of households with elevated radon levels have been tested. [15, 17] There is no information on how many of these homes have been mitigated. The NH EHTP will employ data from multiple sources to explore issues around radon and lung cancer. Findings will be disseminated to increase awareness and action to reduce the risk of radon in the State.

3. Arsenic in Drinking Water & Bladder/Skin Cancer in New Hampshire

Arsenic is a naturally occurring element in the bedrock of New Hampshire and is therefore a natural water contaminant in the state. The human health effects of chronic exposure to low levels of arsenic in drinking water is of particular concern to New Hampshire due to the large number of private bedrock wells. Numerous epidemiological studies have shown an elevated risk for *bladder and skin cancer* associated with exposure to high levels of arsenic, however, studies concerning the risk of bladder or skin cancer from chronic exposure to low levels of arsenic have only recently been undertaken and presently show a range of results.[21]

Studies performed by the USGS in 1993 and 2000 have identified New Hampshire, specifically southeastern New Hampshire, as having moderate to high concentrations of arsenic in drinking water from ground-water sources, primarily private bedrock wells. According to the USGS, nearly one-fifth (19 percent) of randomly selected private bedrock wells tested in southeastern New Hampshire contain concentrations of arsenic that exceed 0.010 milligrams per liter, the U.S. Environmental Protection Agency's maximum contamination level for public water supplies.[1] Based on the population of this region (US Census Bureau, 2000) and water-use data from 1990 (US Census Bureau, 1990), more than 285,000 people are estimated to use private water supplies, about 75

percent of which are private bedrock wells. Results from the USGS studies indicate that 19 percent of bedrock wells in this region have concentrations of arsenic greater than 0.010 mg/L; therefore, it can be estimated that approximately 41,000 people in the region have bedrock wells with arsenic at concentrations of concern for human health. [22]

According to the USGS, this estimate may be conservative because recent well data from New Hampshire indicate that from 1991 to 2000, approximately 95 percent of the wells constructed for private use in this region were bedrock wells (Rick Chormann, State of New Hampshire Geologic Survey, written commun., 2003). Although all public drinking-water supplies must meet the new EPA arsenic standard of 10 ug/l by 2006, private drinking-water supplies are largely unregulated and are not required to meet this new standard. USGS studies show that 19% of randomly selected private bedrock wells tested in southeastern NH contain concentrations of arsenic that exceed 10 ug/l of arsenic. [23]

In 2002, the NH Comparative Risk Project, consisting of a 50 member advisory group, ranked arsenic in groundwater as 16th of 55 environmental threats to NH. The Healthy New Hampshire 2010 agenda listed arsenic in drinking water as one of its main objectives, and the NH Biomonitoring Program and the Dartmouth Medical School Center for Environmental Health Sciences at Dartmouth has selected arsenic in human tissue and urine as a primary environmental exposure to study.

Efforts by State agencies and academia to investigate the effects of arsenic in drinking water on human health have led to the development of a number of surveillance initiatives that may provide the NH EPHT program with high quality datasets. Significant environmental data concerning arsenic is available through the NH Department of Environmental Services and the NH USGS. High quality data for skin and bladder cancer is available through the NH Cancer Registry. Arsenic exposure data is currently being generated by both the NH Biomonitoring Program and the Dartmouth Medical School Center for Environmental Health Sciences' Toxic Metals Research Program from their analysis of skin and nail tissue.

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II. The Inventory Process

A. Identifying Databases for Environmental Factors and Health Effects

Early in the inventory process, the NH EHT Program realized that there were a large number of potential environmental factors that might cause a variety of different health effects in humans. In order to address this complex problem, we divided all the factors into either 1) independent variables (environmental conditions) that would need to be present before a health effect could occur, or 2) dependent variables (health effects) that might result from a variety of risk factors. As we well know, the existence of a particular health effect in proximity to a pollutant is not proof that a causal relationship between the two factors actually exists. In order to evaluate the potential impact of an environmental factor on a particular disease rate, we must identify and control for other variables and ensure that our results are not biased by either behavioral impacts (smoking, drinking, diet, etc.) or demographic factors (age, gender, income, etc.).

The EPHT Program staff realized that a variety of databases exist for monitoring, tracking or surveying a wide range of risk factors—environmental, behavioral, health, and social—for each of our priority areas. In order to identify the most appropriate databases for evaluation we performed an analysis of the environmental and health risk factors involved in each priority area: air quality and asthma, radon in homes and lung cancer, and arsenic in drinking water and bladder/skin cancer.

This analysis is illustrated in Figures 1, 2 & 3 below. After identifying the risk factors for our priority areas, we then selected those that provided the best insight into the association between the environment and our priority health outcomes. This selection process enabled us to then identify the existence of databases that track the most relative risk factors.

Figure 1 below provides an overview of the relevant risk factors for asthma. Asthma is an interesting environmental health endpoint to evaluate due to the large number of triggers that can reduce lung function and promote an asthmatic event. Triggers for asthma include environmental factors such as indoor and outdoor pollutants, weather conditions, as well as, exercise and other physical or emotional challenges to the system. Other triggers include a family history of asthma or allergies (atopy), and conditions such as obesity. The NH EHT Program chose to focus on the health effect or outcome of ‘asthma exacerbation’ events (hospitalizations, medication use, etc.) in order to access higher quality data from hospital discharge records and available data on significant triggers such as air pollution and pollen levels. Asthma prevalence (# of people with the disease at a point in

time) is also of interest, but does not have high quality data sources that can be easily linked to environmental risk factors.

Figure 1: Risk Factors for Asthma Exacerbation and Prevalence

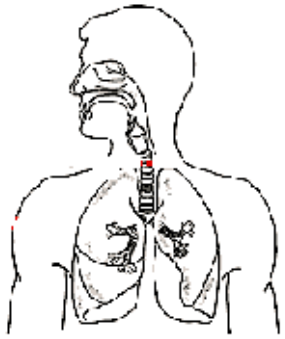
	Hazard Risk Factors (Independent Variables)	**Health Effects/Outcomes (Dependent Variables)**
Environmental Aspects	• Outdoor Allergens • Indoor Allergens •Outdoor Air Pollution • Indoor Air Pollution • Hygiene/Cleanliness •Passive smoke/ETS • Elevation/location • Building Design/Ventilation	 **Asthma Exacerbation Events** **Asthma Prevalence**
Climate	• Cold Weather/Rapid Temp. Change • Heat/Humidity (Heat Stress) • Seasonality • Rainfall	
Behavioral Aspects	• Smoking Status • Diet • Exercise/Inactivity • Exertion • Emotional Distress • School attendance/absence	
Health Status	• Allergic History/Atopic • Family History • Infections (lower and upper respiratory tract) • Obesity • Low Birth Weight • Healthcare Access	
Social Aspects	• Socio-Economic Status (SES) • Occupation • Age • Gender	

Figure 2 below provides an overview of the relevant risk factors for lung cancer in relation to environmental exposures such as radon and smoke exposure. Lung cancer is an important environmental health endpoint that actually has relatively few environmental risk factors. Lung cancer is caused primarily by a long exposure to tobacco smoke, and may also be due to exposure to radioactive gases such as radon. The NH EHT Program chose to focus on the health effect or outcomes of 'lung cancer incidence' (# of new cases per year) and 'lung cancer' deaths in order to access higher quality data from the NH Cancer Registry.

Figure 2: Risk Factors for Lung Cancer

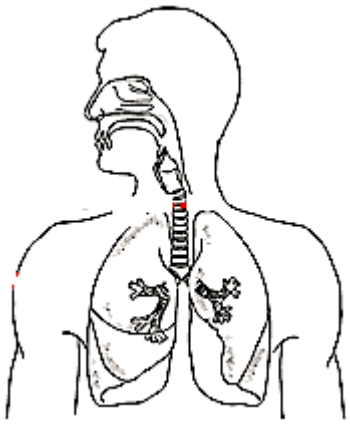
	Hazard Risk Factors (Independent Variables)	**Health Effects/Outcomes (Dependent Variables)**
Environmental Aspects	• Radon in Air • Radon in Water • Asbestos • Air Toxics • Geographic location • Residence (hazard potential) • Level of Occupancy (basement vs. 1st floor) • Residential History • Building Design/Ventilation • ETS/Passive Tobacco Smoke	
Behavioral Aspects	•Mitigation Status (Radon gas treatment) • Smoking Status	**Lung Cancer Incidence**
Health Status	• Cancer History • Genetics	**Lung Cancer Deaths**
Social Aspects	• Socio-Economic Status (SES) • Occupation • Age • Gender	

Figure 3 below provides an overview of the relevant risk factors for skin and bladder cancer in relation to environmental exposures such as arsenic in drinking water. Although arsenic is often high in New Hampshire well water, the relationship between arsenic exposure and cancer is not as strong or well studies as other environmental issues. In addition, the data sets for environmental hazards or exposure are not of high quality at the present moment. Data access and quality are currently being improved by the USGS and the NH Biomonitoring Program. Bladder cancer is caused primarily by a long exposure to tobacco smoke, and may also be due to exposure to heavy metals such as arsenic. The NH EHT Program chose to focus on the health effect or outcomes of skin cancer and bladder cancer 'incidence' (# of new cases per year) and skin cancer and bladder cancer 'deaths' in order to access higher quality data from the NH Cancer Registry. At this time we view this priority health effect as an exploratory assessment for the feasibility of accessing and using evolving data sources.

Figure 3: Risk Factors for Bladder/Skin Cancer

	Hazard Risk Factors (Independent Variables)	**Health Effects/Outcomes (Dependent Variables)**
Environmental Aspects	• Arsenic in Public Drinking Water • Arsenic in Private Well Water • Pesticides in air/food/water • Arsenic in Diet	
Behavioral Aspects	• Smoking Status • Mitigation Status - water treatment • Diet and drinking choices • Bath and Shower Use	**Skin Cancer Incidence** **Skin Cancer Deaths**
Health Status	• Genetics • Skin type/color • Healthcare access (skin screening)	**Bladder Cancer Incidence** **Bladder Cancer Deaths**
Social Aspects	• Socio-Economic Status (SES) • Occupation • Gender • Age	

III. Assessing Priority Health and Environmental Databases

A. Identifying Databases Gaps

Once the appropriate databases were identified based on known or suspected environmental risk factors and health effects of interest, we began the process of assessing the availability and need for specific data sources. The data gap analysis in Tables 1, 2 & 3 below illustrates the results of that investigation. This analysis enabled us to visualize the available data and narrow the scope of our database inventory to include only those databases that we both need and can access. A further discussion of the databases identified below is provided in Section III of this report (Note: The data gap analysis also provided valuable guidance regarding the development of policy and practice recommendations.)

For the following tables, the data sources were divided into columns of hazard data (pollutants, conditions, etc.), exposure data (pollutants in body tissues), and health data for outcomes such as illness or disease. A fourth column was added to evaluate the relationship of these data sources to policy or actions that could lead to better data access or reporting. For all three analyses, a color scheme was developed to identify the status of the data; green shading indicates data (or policy) that is needed and available, yellow shading indicates data needing further evaluation, and red shading indicates data that is needed and unavailable.

The results of the gap analysis for air quality and asthma (see Table 1) indicate that New Hampshire has readily available data on health impacts from asthma via available hospital records and vital statistics, but lacks important data on key environmental hazards such as smoking and allergens. In regard to exposure data, further evaluation is needed regarding access to exposure data from biomonitoring or behavioral surveys. In regard to hazard data, data (or access to data) is lacking on key risk factors such as pollen data, indoor air pollutants, and people's behavior in relation to indoor pollution awareness or control. On the policy side of the equation, mandated reporting and access to needed data is relatively good, except for outdoor allergen data and indoor air pollution data. Both of these hazards could benefit from mandated reporting or the development of a policy for the automatic collection and transfer of electronic data.

Table 1: Air Quality and Asthma

Air Quality & Asthma Data				
Database	**Hazard Data**	**Exposure Data**	**Health Data**	**Policy or Actions**
Outdoor Allergen (UNH)	pollen			reporting/collecting under law
Indoor Air Quality (private)	pollutants & allergens			reporting/collecting under law
Outdoor Air Quality (DES)	ozone & PM2.5			AQ alerts required
Behavioral Risk Factor Surveillance Survey (DHHS)	indoor pollutants & allergens	smoking status	self-reported asthma diagnosis	
Birth Certificates (Secretary of State)		maternal smoking	premature birth	required reporting
Census Bureau	residence (potential hazard)			required reporting
Death Certificates (Secretary of State)			asthma as cause of death	required reporting
Hospitalizations (DHHS)			asthma diagnosis/cost	required reporting
Medicare (UNH)			asthma diagnosis/cost	required reporting
Medicaid (DHHS)			asthma diagnosis/cost	required reporting
Syndromic Tracking Encounter Management System (STEMS) (DHHS & Manchester)			public school nurse-reported asthma event	required reporting

Legend

- Data source needed but unavailable
- Data source needed & available
- Data source requires further evaluation
- Data source unnecessary or not applicable

The results of the data gap analysis for radon in indoor air and lung cancer (see Table 2) indicate that New Hampshire has readily available data on health impacts from radon via available records in the State Cancer Registry and vital statistics, but lacks data on radon mitigation and smoking. In addition, we have access to needed hazard data for radon in household air and behavior data regarding people's awareness of radon. In regard to exposure data, data (or access to data) is lacking on key risk factors such as the mitigation status (i.e. has radon been controlled) and exposure to tobacco smoke from active smoking or environmental tobacco smoke (ETS).

Table 2: Radon in Indoor Air and Lung Cancer

Radon & Lung Cancer				
Database	**Hazard Data**	**Exposure Data**	**Health Data**	**Policy or Actions**
Radon 5 (DES)	indoor radon levels	mitigation status		testing & reporting not required
Cancer Registry (DHHS)			cancer diagnosis	active surveillance
Birth Certificates (Secretary of State)		maternal smoking		required reporting
Smoking/ETS (private)		smoking/ETS		state or local smoking rules
Behavioral Risk Factor Surveillance (DHHS)	self-reported radon levels	mitigation status		
Census Bureau	residence (potential hazard)			required reporting
Death Certificates (Secretary of State)			cancer as cause of death	required reporting
Hospitalizations (DHHS)			cancer diagnosis/cost	required reporting
Medicare (UNH)			cancer diagnosis/cost	required reporting
Medicaid (DHHS)			cancer diagnosis/cost	required reporting

Legend

- Data source needed but unavailable
- Data source needed & available
- Data source requires further evaluation
- Data source unnecessary or not applicable

The results of the data gap analysis for arsenic in drinking water and cancer (see Table 3) indicate that New Hampshire has readily available data on health impacts from arsenic via records in the State Cancer Registry and vital statistics, but lacks data on hazards. In addition, we have limited access to needed exposure data on arsenic in urine and behavior data regarding people's awareness of arsenic exposure risks. In regard to hazard data, data (or access to data) is lacking on key risk factors such as the level of hazard monitored in private well water and mitigation status (i.e. has arsenic been controlled).

Table 3: Arsenic in Drinking Water and Cancer

Arsenic in Drinking Water & Cancer Data				
Database	**Hazard Data**	**Exposure Data**	**Health Data**	**Policy or Actions**
Private Drinking Water (DES)	arsenic in well water	Mitigation status		restricted access
Municipal Drinking Water (DES)	arsenic in water			required reporting
Biomonitoring Program (DHHS)	arsenic in water	arsenic in urine		
Cancer Registry (DHHS)			bladder, skin cancer diagnosis	active surveillance
Behavioral Risk Factor Surveillance Survey (DHHS)	arsenic in water	water consumption		
Census Bureau				required reporting
Birth Certificates (Sec of State)		Maternal Smoking		required reporting
Death Certificates (Sec of State)			cancer as cause of death	required reporting
Hospitalizations (DHHS)			cancer diagnosis/cost	required reporting
Medicare (UNH)			asthma diagnosis	required reporting
Medicaid (DHHS)			asthma diagnosis	required reporting

Legend

- Data source needed but unavailable
- Data source needed & available
- Data source requires further evaluation
- Data source unnecessary or not applicable

IV. Brief Description of Public Health Surveillance and Environmental Monitoring Systems

New Hampshire has a wide range of health and environmental data collected via a number of disparate monitoring and surveillance systems. For the purposes of this inventory report, the NH Environmental Health Tracking Program focused on assessing the number, location, and content of specific health and environmental data monitoring systems related to our priority areas of concern: air quality and asthma, radon in homes and lung cancer, and arsenic in public drinking water and bladder and skin cancer, that have ongoing monitoring of current data and are linked to public health actions (i.e., surveillance systems). These databases include:

- Criteria Air Pollutants database
- Radon Database
- Ambient Drinking Water database
- NH Hospital Discharge Database
- NH State Cancer Registry
- NH ED Syndromic Surveillance Database
- NH Vital Statistics – Births/Deaths

The information required to describe each health and environmental surveillance/monitoring system was incorporated into a metadata matrix regarding health effects, environmental hazards, and exposure databases. Heath-related surveillance/monitoring systems include: NH Hospital Discharge Database, Medicaid Database, NH Cancer Registry, NH Syndromic Surveillance Database, and Vital Statistics Database. The metadata assessed includes: geographic coverage, population information, facility/site characteristics, contaminant characteristics (if applicable), data source, time frame, timeliness, types of data elements, mode of reporting, and use of data.

Environmental and health surveillance systems that are under development in New Hampshire include: public health laboratory biomonitoring system, the Automated Hospital Emergency Department Data (AHEDD) system, the (STEMS), and the University of New Hampshire allergen collection system

Table 4: Health Surveillance Metadata

	NH Hospital Discharge Database	NH Cancer Registry	NH Syndromic Surveillance Database	Vital Statistics
Geographic Coverage				
Statewide Geographic Coverage (yes, no)	yes	yes	yes	yes
Specific Geographic Area (region, county, non-attainment area, etc.)	NA	NA	15 EDs (list towns?)	NA
Population Information				
Statewide Population (population based, hospital based, etc.)	population-based	population-based	hospital-based	population-based
Specific Subpopulation(s) (WIC, uninsured, Insured, gender specific, etc.)	NA	NA	none	NA
Facility/Site Characteristics				
All Facility/Sites Included	NA	NA	NA	NA
Facilities/Sites Specific Sub-group(s) (Major Sources, Area Sources, greater than 10 em-ployees, etc.)	NA	NA	NA	NA
Facility/Site Type (manufac-turing, waste disposal, super-fund site, etc.)	NA	NA	NA	NA
Contaminant Characteris-tics				
Contaminant(s) Included (urban air toxics, etc.)	NA	NA	NA	NA
Specific Concentration Levels vs. Exceedances	NA	NA	NA	NA
Data Source				
Vital Statistics				X
Medical Provider Records (hospital discharge, ED, private practitioner, etc.)	X	X	X	X
School Health Records				
Healthcare Payer Records (Medicaid, Medicare, Private Insurance, HMO)				
Pharmacy Records				
Population Survey (self reported, verified with medical records, etc.)				
Laboratory Records, Sample Analysis		X		
Facility Reports				

Agency Inspections/Reports (compliance, permit, etc.)				
Environmental Monitors				
Time Frame (Reference Year)				
Date System Began Operation	1/1/1985	1/1/1987	9/12/2001	1960's
Interruptions in Operation (missing years of data)	none	none	none	none
Significant Changes over Time	?	none	# of hospitals, 10/01 addition of syndromes, changed case definitions 1/1/03	paper to electronic in 90's
Method/Mode of data collection (electronic, paper, etc.)	electronic	electronic/paper	electronic/paper/phone	electronic/paper
Deletion, addition of variables	?	none	10/01 addition of syndromes	none
Coding changes such as changes in classification of items reported, case definitions	NA	ICD?	changed case definitions 1/1/03, future changes -going to an automated reporting system	ICD9 to ICD10 in 1999
Changes in what population or type of facility/site meets inclusion criteria	none	none	none	none
Timeliness				
Time from data collection to reporting	12-24 mos	2-3 yrs	1-7 days	2-3 yrs
Time from data reporting to availability (public use of files, reports, etc.)	18-24 mos	24-28 mos	NA	24-28 mos
Reporting Frequency	1-3 yrs	1-3 yrs	weekly	1-3 yrs
Collection Frequency	ongoing	ongoing	daily	ongoing
Types of Data Elements				
Identifiers (personal, site/facility, SIC code)	personal	personal	site	personal
Geographic (Lat/Long, Address, Zip Code, County, Census tract, Census Block)	Address	address	ED Address	address
Demographics	yes	yes	no	yes
Diagnosis (include whether medical practitioner or self report)	yes, medical practitioner	yes, medical practitioner	no	yes, medical practitioner
Measure of time (Hour, Date, Month, Year)	hour	Date	Day	date

Concentration level (include whether sampled, monitored, calculated, modeled)	NA	NA	NA	NA
Chemical type	NA	NA	NA	NA
Emission rate/discharge rate (include whether monitored, calculated, modeled)	NA	NA	NA	NA
Environmental media type (Air, Water, Soil, Sediment)	NA	NA	NA	NA
Compliance status	NA	NA	NA	NA
Source of emission/discharge (e.g. Stationary, Point, Non-point, Area, Mobile, Biogenic, Stack, Fugitive, etc.)	NA	NA	NA	NA
Mode of Reporting				
Type of Electronic Reporting (email, FTP, diskette, etc.)	?	?	email spreadsheet	?
Paper	none	?	fax form/spreadsheet	?
Voluntary reports	NA	?	yes	NA
Required reports	yes	?	none	yes
Active/Passive system (health data only)	Passive	Passive	Active	Passive
Use of Data				
Public health or environ-mental actions	Yes	Yes	Yes	Yes
Program planning	Yes	Yes	No	Yes
Public education	Yes	Yes	Yes	Yes
Program evaluation	Yes	Yes	No	Yes
Monitoring trends	Yes	Yes	Yes	Yes
Compliance monitoring	NA	NA	NA	NA
Regulation development	NA	NA	NA	NA
Hazard identification (e.g. alerts, spills, etc.)	NA	NA	NA	NA
May also want to take into account current, past, and proposed future uses.				
May also want to indicate what level(s) of government use the data set: (local only [data not submitted to state or federal level, state only [data not submitted to federal level], data submitted to federal agency)				

Table 5: Environmental Monitoring Metadata

	Criteria Air Pollutants Database	NH Indoor Air Radon Monitoring Database	NH Municipal Drinking Water Database
Geographic Coverage			
Statewide Geographic Coverage (yes, no)	Yes	Yes	Yes
Specific Geographic Area (region, county, non-attainment area, etc.)	NA	NA	NA
Population Information			
Statewide Population (population based, hospital based, etc.)	NA	NA	NA
Specific Subpopulation(s) (WIC, uninsured, Insured, gender specific, etc.)	NA	radon test volunteers	Public water supply systems
Facility/Site Characteristics			
All Facility/Sites Included	Yes	NA	Yes
Facilities/Sites Specific Subgroup(s) (Major Sources, Area Sources, greater than 10 employees, etc.)	No	NA	Community, non-transient non-community, transient, non-community
Facility/Site Type (manufacturing, waste disposal, superfund site, etc.)	No	homes, some schools	water supply
Contaminant Characteristics			
Contaminant(s) Included (urban air toxics, etc.)	O3, PM, SO2, NOx, CO	radon (air)	200 analytes
Specific Concentration Levels vs. Exceedances	Specific conc levels	4.0 picocuries/L max	Specific conc levels
Data Source			
Vital Statistics	NA	NA	NA
Medical Provider Records (hospital discharge, ED, private practitioner, etc.)	NA	NA	NA
School Health Records	NA	NA	NA
Healthcare Payer Records (Medicaid, Medicare, Private Insurance, HMO)	NA	NA	NA
Pharmacy Records	NA	NA	NA
Population Survey (self reported, verified with medical records, etc.)	NA	NA	NA
Laboratory Records, Sample Analysis	Yes	NA	Yes

Facility Reports	Yes	NA	Yes
Agency Inspections/Reports (compliance, permit, etc.)	No	NA	Yes
Environmental Monitors	Yes	voluntary test/ private homes	No
Time Frame (Reference Year)			
Date System Began Operation	1988	1990	1989
Interruptions in Operation (missing years of data)	winter months for some pol-lutants	No	No
Significant Changes over Time	No	No	No
Method/Mode of data collection (electronic, paper, etc.)	electronic, paper	paper	electronic
Deletion, addition of variables	Yes	No	No
Coding changes such as changes in classification of items reported, case definitions	Yes	No	No
Changes in what population or type of facility/site meets inclusion criteria	No	No	No
Timeliness			
Time from data collection to reporting	30 days	varies (weeks/months)	
Time from data reporting to availability (public use of files, reports, etc.)	90 days	varies (weeks/months)	
Reporting Frequency	hourly, daily, monthly	varies (weeks/months)	daily
Collection Frequency	hourly, daily, monthly	ongoing	monthly, quarterly
Types of Data Elements			
Identifiers (personal, site/facility, SIC code)	site	personal	system
Geographic (Lat/Long, Address, Zip Code, County, Census tract, Census Block)	Lat/Long	address	Address
Demographics	No	No	Population served
Diagnosis (include whether medical practitioner or self report)	NA	No	NA
Measure of time (Hour, Date, Month, Year)	Hour	No	Date
Concentration level (include whether sampled, monitored, cal-culated, modeled)	sampled, monitored	sample result	sampled
Chemical type	gas	gas	water

Emission rate/discharge rate (include whether monitored, calculated, modeled)	NA	NA	NA
Environmental media type (Air, Water, Soil, Sediment)	Air	Air	Water
Compliance status	NA	NA	Yes
Source of emission/discharge (e.g. Stationary, Point, Non-point, Area, Mobile, Biogenic, Stack, Fugitive, etc.)	NA	Basement	NA
Mode of Reporting			
Type of Electronic Reporting (email, FTP, diskette, etc.)	FTP		FTP
Paper	X	X	
Voluntary reports		X	
Required reports	X		X
Active/Passive system (health data only)			
Use of Data			
Public health or environmental actions	Yes	Yes	Yes
Program planning	Yes	Yes	Yes
Public education	Yes	Yes	Yes
Program evaluation	Yes	No	Yes
Monitoring trends	Yes	Yes	Yes
Compliance monitoring	Yes	No	Yes
Regulation development	Yes	No	Yes
Hazard identification (e.g. alerts, spills, etc.)	Yes	Yes	Yes
May also want to take into account current, past, and proposed future uses.			
May also want to indicate what level(s) of government use the data set: (local only [data not submitted to state or federal level, state only [data not submitted to federal level], data submitted to federal agency)	local, state, federal	state only	local, state, federal

Table 6: Exposure Monitoring Metadata

	BRFSS
Geographic Coverage	
Statewide Geographic Coverage (yes, no)	yes
Specific Geographic Area (region, county, non-attainment area, etc.)	none
Population Information	
Statewide Population (population based, hospital based, etc.)	population-based
Specific Subpopulation(s) (WIC, uninsured, Insured, gender specific, etc.)	none
Facility/Site Characteristics	
All Facility/Sites Included	NA
Facilities/Sites Specific Subgroup(s) (Major Sources, Area Sources, greater than 10 employees, etc.)	NA
Facility/Site Type (manufacturing, waste disposal, superfund site, etc.)	NA
Contaminant Characteristics	
Contaminant(s) Included (urban air toxics, etc.)	NA
Specific Concentration Levels vs. Exceedances	NA
Data Source	
Vital Statistics	
Medical Provider Records (hospital discharge, ED, private practitioner, etc.)	
School Health Records	
Healthcare Payer Records (Medi-caid, Medicare, Private Insurance, HMO)	
Pharmacy Records	
Population Survey (self reported, verified with medical records, etc.)	X, self-report
Laboratory Records, Sample Analy-sis	
Facility Reports	
Agency Inspections/Reports (com-pliance, permit, etc.)	

Environmental Monitors	
Time Frame (Reference Year)	
Date System Began Operation	1987
Interruptions in Operation (missing years of data)	none
Significant Changes over Time	change of questions, change in sampling? Check with Jody
Method/Mode of data collection (electronic, paper, etc.)	telephone survey
Deletion, addition of variables	yes
Coding changes such as changes in classification of items reported, case definitions	none
Changes in what population or type of facility/site meets inclusion criteria	none
Timeliness	
Time from data collection to reporting	not available
Time from data reporting to availability (public use of files, reports, etc.)	6-12 mos
Reporting Frequency	annually
Collection Frequency	annually
Types of Data Elements	
Identifiers (personal, site/facility, SIC code)	none
Geographic (Lat/Long, Address, Zip Code, County, Census tract, Census Block)	state
Demographics	yes
Diagnosis (include whether medical practitioner or self report)	diagnosis, self-report
Measure of time (Hour, Date, Month, Year)	Year
Concentration level (include whether sampled, monitored, calculated, modeled)	NA
Chemical type	NA
Emission rate/discharge rate (include whether monitored, calculated, modeled)	NA
Environmental media type (Air, Water, Soil, Sediment)	NA
Compliance status	NA

Source of emission/discharge (e.g. Stationary, Point, Non-point, Area, Mobile, Biogenic, Stack, Fugitive, etc.)	NA
Mode of Reporting	
Type of Electronic Reporting (email, FTP, diskette, etc.)	none
Paper	none
Voluntary reports	NA
Required reports	NA
Active/Passive system (health data only)	active
Use of Data	
Public health or environmental actions	Yes
Program planning	Yes
Public education	Yes
Program evaluation	Yes
Monitoring trends	Yes
Compliance monitoring	NA
Regulation development	NA
Hazard identification (e.g. alerts, spills, etc.)	NA
May also want to take into account current, past, and proposed future uses.	
May also want to indicate what level(s) of government use the data set: (local only [data not submitted to state or federal level, state only [data not submitted to federal level], data submitted to federal agency)	

V. Comprehensive Description of Public Health Surveillance and Environmental Monitoring Systems

A. NH Department of Health and Human Services (DHHS) Surveillance/Monitoring Systems

Behavioral Risk Factor Surveillance System (BRFSS)

The NH Behavioral Risk Factor Surveillance System (BRFSS) is a telephone survey of self-reported health behaviors that has been collected in New Hampshire since 1987 through the present. The data source for this database is a random telephone survey of self-reported health information and behaviors. Data element specifications are determined by the cooperative agency, CDC, therefore standardized across all surveys.

After being assessed for quality and completeness, annual datasets are available for analysis 18-24 months after the completion of data collection. The database is federally funded by the Centers for Disease Control and Prevention (CDC) and is performed in all states and territories through a cooperative agreement with CDC. In New Hampshire, the BRFSS database is backed up daily, excellent quality assurance protocols are in use and each data record (interview) is largely complete. Supporting documentation for the database include a codebook and user guide. The survey is carried out throughout the calendar year, with completed surveys distributed among the twelve months of the year.

The NH BRFSS database is stored on a secure server within the Department of Health and Human Services in SAS, SPSS and STATA. The database data steward can access the data through the secure server. Other users can access the data through a data request process. A data request form can be found on the web (http://www.dhhs.state.nh. us/DHHS/HSDM/data-requests.htm). The database is populated with data by a contracted agency, ORC Macro International in Burlington, VT, which carries out the telephone survey. Data is entered as the survey is completed following a specific protocol provided by CDC. This database consists of individual human exposure outcomes, health outcomes, and human morbidity data such as diagnosis of asthma or diabetes, pregnancy status and sexual behavior. This database plays a significant role in public health program planning and evaluation at the state and federal level. Data is geographically referenced by zip code and town, and temporally referenced by the date of the survey.

No major customer off the shelf (COTS) or custom applications are used. The database is stored on a secured DHHS server and is further protected through the use of firewalls. The data steward for this database, Jody Wilson, Assistant State Epidemiologist in the Bureau of Healthcare

Research/Health Statistics and Data Management section of NH DHHS, accesses the data through a secured server. Other users can access the data through a data request process, the data request form can be found on the web at http://www.dhhs.state.nh. us/DHHS/HSDM/data-requests.htm. Data can be provided via electronic storage (disk or cd-rom) or on paper. A contracting agency conducts the telephone survey and data is entered into a database as surveys are completed following a specific protocol provided by CDC. The NH DHHS database is updated monthly with this data from the contracting agency. Aggregated national level and some state level BRFSS data are available via the web at http://www.cdc.gov/brfss/. This data is sent to CDC annually to become part of the national BRFSS database. There is no other ongoing integration with other databases, although the data is integrated per specific analyses. Some examples of internal users of this database include the NH DHHS Tobacco Control Program for data on smoking behaviors, the Asthma Control Program for asthma prevalence, Rural Health, and Diabetes. Past external users of this data have included towns, cities, and academic institutions.

Aggregated national level and some state level data is available via the web at http://www.cdc.gov/brfss/. Data is sent to CDC annually to become part of the national BRFSS database. No other ongoing integration is conducted with other databases. Other databases are integrated with the BRFSS database per specific analyses. Internal users include: Tobacco Control Program for smoking behaviors, Asthma Control Program for asthma prevalence, Rural Health, and Diabetes. Data is provided via disk or cd-rom, on paper, or can query through CDC website for NH. External users include: cities and academic institutions. The data steward for this database is Jody Wilson, BRFSS Coordinator, NH DHHS/Office of Medicaid Business and Policy/Bureau of Health Planning and Research

Database: **Behavioral Risk Factor Surveillance Survey (BRFSS)**
Where: NH DHHS/DPHS
Who: Jody Wilson, (603) 271-4671
Content: A random telephone survey of self-reported health information and behaviors. Data element specifications are determined by the cooperative agency, CDC, therefore standardized across all surveys. Data collected from 1987 to present.

NH Hospital Discharge Database

The NH Hospital Discharge Database includes all acute care discharges from NH hospitals. It includes medical information such as diagnosis and procedural codes, demographical and billing information. This dataset was created in accordance with RSA 126:25,26,27 and is used in public health trend monitoring, policy development, program planning and evaluation, and public education. This data collection has been ongoing since 1985 and annual data is available12-24 months after the end of the year. Hospital records are the primary sources of data and the dataset is updated semi-annually when each hospital sends its data to the New Hampshire Hospital Association. NHHA acts as the "trusted party," protecting the rights and interests of each individual hospital. Diagnosis and treatment codes, deaths, births, birth-related outcomes and birth defects occurring while the patient is classified as inpatient or in admissions are all collected in this dataset.

The NH Hospital Discharge Database resides in a secure server within the Department of Health and Human Services. The operating database types used include Oracle and MS Access. Oracle/ MS Access. Data requests are submitted through the Office of Medicaid Business and Policy. Data can be supplied electronically via email or disk, cd, etc. Data may be available on the Web Reporting Query System (WRQS) in the future for access to public information but not for research. There is no level of integration between this dataset and other databases on a routine basis. However, the data is integrated in the course of analysis for specific requests or reports. User groups include internal Department of Health and Human Services users, e.g. Maternal and Child Health Section.

The dataset is maintained in the Office of Medicaid Business and Policy under the Bureau of Health Planning and Research. Andrew Chalsma, Senior Management Analyst in the Office of Medicaid Business and Policy is the data steward of this dataset.

No national standards are used for this dataset. Data is collected from each hospital in NH with several disparate medical record data forms is concentrated into one standard format through "trusted authority" NHHA and Maine Health Information Center. Communication about data problems, discrepancies, etc., go through NHHA from ME Health Information Center and then to NH DHHS Office of Medicaid Business and Policy and back to reporting hospitals until data is sufficiently cleaned and standardized.

Database: **NH Hospital Discharge Database**

Where: NH DHHS/DPHS

Who: Andrew Chalsma, (603) 271-4514

Content: Database of all acute care discharges from NH hospitals that includes medical information such as diagnosis and procedural codes, demographical and billing information. Data collected since 1985.

NH Cancer Registry

The New Hampshire State Cancer Registry (NHSCR), in operation since 1987 at the Norris Cotton Cancer Center under a contract between the State and Dartmouth Medical School, supports human and computer systems to provide comprehensive cancer surveillance for the residents of New Hampshire. The registry receives information of reportable incidences of cancer from hospitals, pathology labs, clinics, and physicians. Most of the information is transmitted electronically in a North American Association of Central Cancer Registry (NAACCR) format by reporting hospitals. Following national best practices, NHSCR uses a variety of software to process the cases and to produce reports and data extracts for both national reporting (i.e. Central for Disease Control and Prevention National Program of Cancer Registries Cancer Surveillance Systems) and local reporting (DHHS, medical researchers, etc.).

The New Hampshire cancer surveillance system is described in state rules and regulations.To ensure that our cancer data definitions and codes are standard and consistent with those used by regional and national databases, our population-based registry collects and maintains incidence cancer data as specified by NAACCR. The NAACCR data set is comprised of all data items recommended for use by the major cancer registry standard-setting organizations, including SEER and NPCR. NHSCR's own audits are in accordance with New Hampshire rules and regulations as well as with national recommendations from NPCR and NAACCR.

Hospitals that provide comprehensive cancer surveillance generally follow the guidelines for data collection and case processing prescribed by the Committee on Cancer of the American College of Surgeons, Chicago, Illinois. The NAACCR data standards and data dictionary is designed to develop comparable data, and the exchange record layouts are designed to facilitate electronic transmission of cancer registry data among registries for multiple purposes. Most of the information is transmitted electronically to NHSCR by hospitals in NAACCR format. Other formats used include HL-7, MS Excel, comma-delimited text, and web-captured information. Reporting hospitals collect and transmit cancer data in NAACCR format on a regular basis, at least once a month. NHSCR staff abstract cases identified at smaller hospitals. Collection occurs at least monthly. Collection at specialized facilities occurs less frequently. At least annually, NHSCR issues to all reporting facilities documents that outline reporting requirements. Currently, the NHSCR is using NAACCR's record layout version 10.2. Version 11 will be effective with cases diagnosed in 2005. The systems in use have all of the data items required by the National Program for Cancer Registries (NPCR) of the

CDC, SEER program, North American Association of Central Cancer Registries (NAACCR), and American College of Surgeons.

The primary software used by NHSCR for case management is the Rocky Mountain Cancer Data System (RMCDS). RMCDS is a Windows-based software program designed to facilitate all data entry and statistical analysis functions of the cancer registry in an efficient and timely manner. This program meets national standards regarding abstracting, follow-up, basic database management functions, acceptable match/merge routines for avoiding duplicate cases, and basic reports. RMCDS software is also capable of exporting data so that additional coding and analysis can be performed via other software programs.

The primary platform of the NHSCR is Intel systems. The operating system is Windows XP Pro, Windows 2003 Server. Database Systems include Rocky Mountain Cancer Data Systems, Salt Lake City; SAS 9.1, SAS Institute, Cary, North Carolina. Specialized Software includes GenEdit-sLite, CDC NPCR, Utility; InterRecordEdits Utility, CDC NPCR; LinkPlus Matching, CDC NPCR.

NHSCR sits behind the network security system of Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire. There is a website using SSL to registered users to enter and transmit data. The NHSCR has its own Windows 2003 Active Directory domain. All data and programs are available on local computers. NHSCR has a website used by registered users to enter and transmit data. User groups include NHSCR staff that includes 7 professionals that work together to identify, abstract, edit, consolidate, and report on cancer in New Hampshire.

Data from the state registry is transferred to NH DHHS Bureau of Health Statistics for storage and analysis. The data is received by the Bureau in a text file that is stored in Oracle on a restricted drive in the DHHS Bureau of Health Statistics, and is backed up daily. The data is converted to SAS for analysis and MS Access. Data is used for cancer incident data analysis and GIS mapping for external and internal requesters. Most identifiers are removed and this data is used for data analysis, but if a client requires the personal identifiers they have to provide all necessary documentation for such a request that is then put forth before a committee for approval. The data steward at the Bureau of Health Statistics is Sai Cherala, Cancer Epidemiologist, MD, MPH.

NHSCR Staff includes: Epidemiologist/MD; NHSCR Director/epidemiologist for overall supervision of NHSCR personnel and activities, ongoing review of data, and supervision of reports; Network and Computing Administrator and Database Manager/Data Analyst creates customized datasets for internal and external customers, process electronic data transfers, design and implement

quality improvement projects, generates and analyzes cancer registry data, prepares reports in response to data requests; NCRA Certified Tumor Registrars edit cancer data for quality and completeness, resolve discrepancies in hospital vs. central registry cancer data, merge and consolidate cases reported by multiple facilities, identify and abstract patient cancer information into database; Cancer Field Auditor performs case-finding audits to identify possible missed cases and verifies case abstracts are in accordance with New Hampshire rules and regulations.

Database: **NH State Cancer Registry**
Where: NH DHHS/DPHS
Who: Sai Cherala, (603) 271-7812
Contractor: Maria Celaya, Cancer Registry, Norris Cotton Cancer Center, Dartmouth-Hitchcock Medical Center
Content: The New Hampshire State Cancer Registry (NHSCR), supports human and computer systems to provide comprehensive cancer surveillance for the residents of New Hampshire. The registry receives information of reportable incidences of cancer from hospitals, pathology labs, clinics, and physicians. Data collected since 1987.

NH Vital Statistics (Births) Database

Health Statistics & Data Management analyzes information from reported birth records and distributes statistical reports to government agencies and other requesting public and private organizations. The data is used to plan, administer and evaluate health and other programs. The Division of Vital Records in the Office of the Secretary of State is responsible to collect information on births to NH residents and births occurring in NH in accordance with NH Administrative Rules. Hospitals and midwives report the information to the Division of Vital Records. Out-of-state births to NH residents are collected by the state where the birth occurs and reported to NH through an interstate exchange agreement. HSDM receives birth data from the Division of Vital Records.

Birth data consists of information from a birth certificate including:

- Newborn's sex, weight, period of gestation, date of birth and congenital anomalies,
- Mother's and father's residence (down to street address level), age, race and ancestry, and
- Many characteristics of the pregnancy and birth including maternal smoking and alcohol use, method of delivery, use of prenatal care and complications of the pregnancy.

The birth data is typically considered complete and available for analysis approximately eight months after the close of a calendar year. The most recent birth data available for analysis is calendar year 2002. In addition to performing special analyses of the data, HSDM publishes an annual vital statistics report that contains tabulations of birth data.

The births database is housed in the Vital Statistics department within the NH Division of Vital Records Administration, Bureau of Healthcare Resource within the Office of the Secretary of State. The database steward for NH Births is Andrew Chalsma, senior management analyst. The database resides on a network server operating under Windows and protected by the network firewall. Presently the software used is Oracle, with older files in Access. The system is accessed through the server only by authorized personnel in the NH Secretary of State’s office and by agency personnel by permission. The database is populated with data from birth certificates submitted by hospitals and town clerks and entered into the database. The public can query birth information via the NH DHHS website: www.dhhs.nh.gov. Primary users of the data include authorized Bureau of Healthcare Resources staff, NH DPHS staff, and researchers.

Database: **NH Vital Statistics (Births)**

Where: NH DHHS/DPHS

Who: Andrew Chalsma, (603) 271-4514

Content: Information from a birth certificate, including newborn's sex, weight, period of gestation, date of birth and congenital anomalies, mother's and father's residence (down to street address level), age, race and ancestry, and other characteristics of the pregnancy and birth including maternal smoking and alcohol use, method of delivery, use of prenatal care and complications of the pregnancy. Data collection began in 1968 with electronic data available from 1980 to present.

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NH Vital Statistics (Deaths) Database

Health Statistics & Data Management analyzes information from the records of reported deaths and distributes statistical reports to government agencies and other requesting public and private organizations. The data is used to plan, administer and evaluate health and other programs. The Bureau of Vital Records is responsible to collect information on deaths to NH residents and deaths occurring in NH as mandated by NH Administrative Rules. Funeral home directors and the medical examiner report the information to Vital Records. Information about out-of-state deaths to NH residents is collected by the state where the death occurs and reported to NH through an interstate exchange agreement. HSDM receives the death data set from the Bureau of Vital Records.

Death data consists of information from a Death Certificate including but not limited to:

- Sex and age, residence (down to street address level), occupation and education of the deceased,
- Location and date of death, and
- Underlying cause of death as well as up to 14 contributing causes of death.

Death certificate information is filed electronically to the Division of Vital Records Administration by funeral directors within 24 hrs of a medical doctor signing the death certificate. Information is complete and available for analysis approximately 12 months after the close of a calendar year. The most recent death data available for analysis is calendar year 2001. In addition to performing special analysis of the data, HSDM publishes an annual Vital Statistics report that contains tabulations of death data.

The deaths database is housed in the Vital Statistics department within the NH Division of Vital Records Administration, Bureau of Healthcare Resource within the Office of the Secretary of State. The database steward for NH Deaths database is Andrew Chalsma, senior management analyst. The database resides on a network server operating under Windows and protected by the network firewall. Presently the software used is Oracle, with older files in Access. The system is accessed through the server only by authorized personnel in the NH Secretary of State's office and by agency personnel by permission. The database is populated with data from death certificates submitted by hospitals, funeral directors, and coroners and entered into the database. The public can query death information via the NH DHHS website: www.dhhs.nh.gov. Primary users of the data include author-

ized Bureau of Healthcare Resources staff, NH DPHS staff, and researchers. The Births and Deaths databases are linked to each other via infant birth certificate number on the death certificate.

Database: **NH Vital Statistics (Deaths)**
Where: NH DHHS/DPHS
Who: Andrew Chalsma, (603) 271-4514
Content: Information from a death certificate including but not limited to sex and age, residence (down to street address level), occupation and education of the deceased, location and date of death, and underlying cause of death, as well as up to 14 contributing causes of death. Data collection began in 1968 with electronic data available from 1980 to present.

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NH ED Syndromic Surveillance Database

The ED Syndromic Surveillance System collects data from 15 emergency departments in NH on the weekly incidence of the following four syndromes: fevers, GI symptoms, rashes with fever, and respiratory symptoms. Case definitions for each of the syndromes is limited to the following: patients falling into the fever category are those with temperatures greater than or equal to 100.0 degrees Fahrenheit with **no** rash and **no** GI or respiratory symptoms. Cases in the GI symptoms category are any patients with a history of vomiting and/or diarrhea. Patients in the rash category are any patients with a rash accompanied by a fever. Patients in the respiratory symptoms category include any patients with non-traumatic conditions resulting in breathing difficulty. The syndrome definitions used are the standard definitions set by the Centers for Disease Control and Prevention.

Permission from hospital CEOs was solicited to share the data among the participating hospitals. RSA 141-C provides the legislative authority for NH DHHS to have access to this data. The project is funded through bio-terrorism grants to track disease trends by monitoring syndromes of patients in emergency departments. This data collection has been ongoing since September 2001 through the present, with some breaks in the data collection. The data records for this system are geographically referenced by each hospital and temporally referenced by the day of the diagnosis. The database is populated with data using web based data entry on a limited access, password protected site through a contractor, Scientific Technologies Corporation (STC). The raw data can be downloaded from the secured website by the data steward, Kim Fallon, Bioterrorism Surveillance Coordinator in the Bureau of Disease Control and Laboratory Sciences, under the Division of Public Health Services in the NH Department of Health and Human Services. The database is stored on a SQL server at the Manchester, NH Health Department.

This dataset is not integrated with other data sources. The quality assurance protocols in use are considered good with a high level of completeness in the data records. The only user of this database is the data steward who compiles, enters and analyzes the data. Nurses and/or hospital administrative staff voluntarily collect the data daily at each hospital. Daily data is sent in to DHHS the following day before 1 pm, either by fax, email or phone. Weekly reports are put together by the data steward and disseminated throughout BDCLS and to participating hospitals. Weekly reports summarize data, by syndrome, by hospital, and statewide, for the previous week. Follow up telephone calls are made to hospitals if syndrome numbers meet pre-specified criteria and may prompt an outbreak investigation.

Presently, the ED Syndromic Surveillance System will be supplemented by the Automated Hospital Emergency Department Data (AHEDD) system. This system will automate the data collection described above. In its initial phase, AHEDD will collect data from four hospitals with the necessary IT infrastructure already in place. The automated data collection system will provide for a more efficient, systematic and consistent methodology resulting in cleaner and more standardized data.

Database: **NH ED Syndromic Surveillance**
Where: NH DHHS/DPHS
Who: Christopher Taylor, (603) 271-4987
Content: Data from 15 emergency departments in NH on the weekly incidence of the following four syndromes: fevers, GI symptoms, rashes with fever, and respiratory symptoms. Data collection began in September 2001.

B. NH Department of Environmental Services Monitoring Systems

NH Ambient Air Monitoring Database

This database includes all of the ambient air monitoring data collected by the New Hampshire Department of Environmental Services (DES). The data elements consist of concentration values for air pollutants including particulate matter (PM), ozone (O_3), sulfur dioxide (SO_2), oxides of nitrogen (NO_X), carbon monoxide (CO), wind speed (WS), wind direction (WD) and temperature collected at the 20+ air monitoring stations operated by DES. All measurement values are geographically referenced by monitoring station longitude and latitude, and are temporally referenced on an hourly, daily and annual average concentration basis. It was created in the 1970s in order to comply with the federal requirements of the Clean Air Act, and to demonstrate compliance with National Ambient Air Quality Standards (NAAQS). Data is backed up daily and has been continuously collected and stored in its current format since 1988. All data must undergo strict quality assurance/quality control (QA/QC) procedures in accordance with the EPA-approved DES Quality Assurance Project Plan (QAPP) to assure data precision, accuracy, completeness and representativeness. Consequently, data quality and completeness are considered excellent. Data can be made available to users after QA/QC data validation has been completed – usually within one month after collection. The database currently operates using MS Access database software, and data are stored on a secure, password protected DES network drive.

Data access for internal users within the DES Air Resources Division, Technical Services Bureau is enabled through a secure server. Data is also provided through US EPA's Aerometric Information Retrieval System (AIRS) to the EPA Air Quality System (AQS) database. The AQS is a computer-based repository of information about airborne pollution containing measurements of air pollutant concentrations in the 50 United States, plus the District of Columbia, Puerto Rico, and the Virgin Islands. All collected ambient air monitoring data is public information and is available on request. Data is electronically available from DES via email, floppy disk or compact disk for external users and other DES internal users. Internal users of this data include, but are not limited to DES air program planners, air pollution forecasters environmental epidemiologists and environmental program managers. External users have included US EPA, environmental non-profit organizations and businesses. Supporting documentation includes a data dictionary and a data users guide. The data steward is Daniel Terrell, Data Analyst in the DES Air Resources Division, Compliance Bureau.

Database: **NH Air Monitoring Database**

Where: NH DES

Who: Daniel Terrell, (603) 271-0913

Content: Ambient air monitoring data collected by the 20+ air monitoring stations operated by NH DES, including particulate matter (PM), ozone (O_3), sulfur dioxide (SO_2), oxides of nitrogen (NO_X), carbon monoxide (CO), wind speed (WS), wind direction (WD) and temperature. Data collection began in 1988.

NH Ambient Drinking Water Database

The purpose of the NH Drinking Water Database is to track information required by the federal Safe Drinking Water Act and state rules applying to public water. Within the Drinking Water Database, staff maintains information on NH's public drinking water supplies, youth camps, bottled water facilities, and drinking water sources. The database contains facility information, site visits and system deficiencies and monitoring data including sampling sites, sampling schedules, and sample results and enforcement actions. Database modules include: 1) Contact information; 2) Certified Operator Program; 3) Permits and Fees; 4) Site visits; 5) Site visits; and 6) Design review tracking. Most of the information collected in the database is required for federal reporting to EPA's Safe Drinking Water Information System (SDWIS).

There are three types of Public Water Systems (PWSs): Community Systems (C): are water systems designed to serve at least 25 residents on a year round basis. Examples include municipal water systems (Manchester and Concord), and small systems serving mobile home parks, condominiums, and single family housing developments, etc. Non-transient, non-community public water systems (NTNC) or (P): are water systems designed to serve at least 25 people for at least 6 months per year. Examples include day cares, schools, workplaces and commercial properties. Transient/non-community public water system (NCWS) or (N): are systems designed to serve at least 25 people, for at least 60 days per year. Examples include restaurants, campgrounds, motels, recreation areas and services stations.

The Water Supply Engineering Bureau tracks approximately 710 "Cs," 450 "NTNCs," and 1,150 "NCWSs." "Cs" and "NTNCs" are required to have Certified Operators. There are currently 963 NH Certified Operators. WSEB requires that PWSs owners/primary contacts keep their contact lists current with the bureau. Although we do not track the town health officer in the WSEB contact database, we try to contact them when public health issues arise.

Database: **NH Ambient Drinking Water Database**
Where: NH DES
Who: Laurie Cullerot, (603) 271-2954
Content: Facility information, site visits and system deficiencies, monitoring data including sampling sites, sampling schedules, and sample results and enforcement actions. Data collection began in 1989.

NH Radon Database

The NH Radon database stores the test results of home-based indoor radon in air tests based on geographic distribution of test results. It allows for the quantification of size of risk, GIS mapping, retrieval and comparison of data. Analytical functions are performed through Access.

The server hardware type used to store the data is Intel and the operating system is Windows. The type of database software used is Access 2000. The database is protected by DHHS firewall, security "write privileges" and password protection. The system is accessed by the Web.

The database is populated by direct data entry via electronic download. This database does not have web services available and does not integrate with any other database. User groups include only the Radon Program staff. The personnel dedicated to this database include only the program manager, David Chase. There are no data exchange templates or data models. The data standards for this database meet QA/QC protocols approved by EPA. Standardized collection instruments include specific radon test devices. There are no standardized collection times and no specific standards for coding and reporting.

Database: **NH Radon Database**
Where: NH DES
Who: Dave Chase, (603) 271-4764
Content: Test results of home-based indoor radon in air tests based on geographic distribution of test results. Data collection began in 1986.

VI. Future Assessment of Health Surveillance and Environmental Monitoring Information Databases

A. Department of Health and Human Services Information Technology (IT) Infrastructure and Architecture

Numerous policies and practices are in-place in the State of NH, addressing the security of data collected by the state as well as provided to the State. These policies and practice are further refined to address access, research, reporting and investigation to ensure that only authorized personnel have access to the repositories and treat the information in accordance to strict state and federal guidelines regarding confidentiality and release. The DHHS practices and policies encompass federal guidance (e.g., HIPAA), State of NH general court RSAs (i.e., Section 4-D, Section 126:25, Section 126A:11, Section 141-B, and Section 141-C), as well as divisional policies (i.e., Guidelines for the Administration and Release of Public Health Data, 2001). The DHHS data security policy is published on the DHHS website, www.dhhs.nh.gov/DHHS/HSDM/LIBRARY/Policy-Guideline/data-release.htm

Collectively these rules, regulations and practices provide the foundation upon which data security, patient privacy, access and release, as well as physical storage and infrastructure are based. Security in the State of NH equates to strong authentication and 7/24 monitoring of data repositories. These practices reflect industry standards as well as guidelines and initiatives by CDC with respect to projects like NEDSS (National Electronic Disease Surveillance System) and PHIN (Public Health Information Network). Privacy is not only governed by HIPAA but internal state statutes and guidelines that may further restrict not only access to data but what information may be released to the public when constructive identification is at issue.

B. NH Department of Environmental Services Information Technology (IT) Infrastructure and Architecture

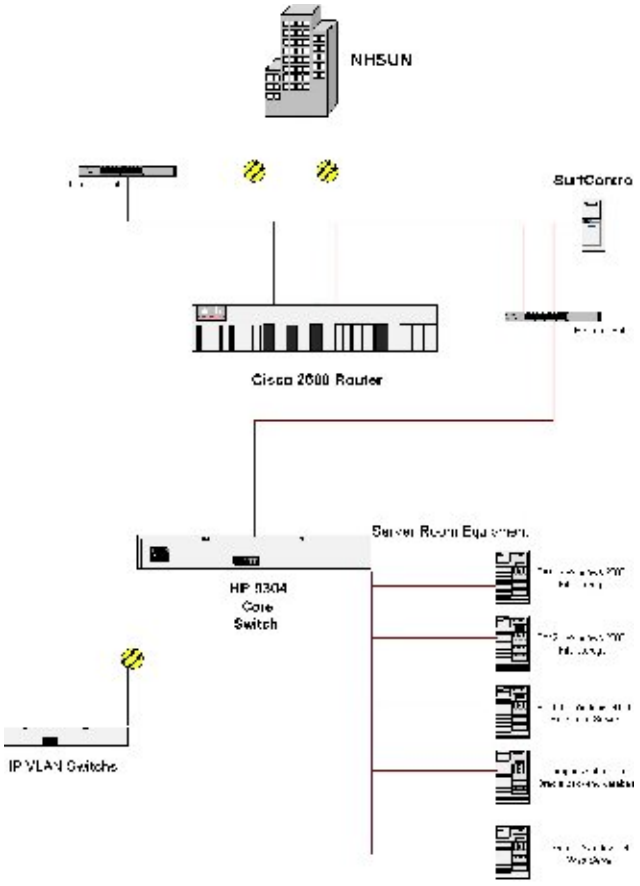
DES privacy policy is based on the State's privacy policy, which outlines DES security protocols regarding personally identifiable information exchanged over the Internet. Electronic security is maintained by DES and adheres to the following: SSL encryption which protects the data as it travels over the Internet; pin/password and login identifiers for those that need to gain access to the DES Web server; and each pin/password application is reviewed by an individual from DES and the approval or rejection of the application is determined. DES has a web review board consisting of individuals representing different bureaus within DES. The purpose is to review the contents of any

additions or changes to the DES web site pages prior to a new public listing. The majority of public requests for data are handled through the DES Public Information Center, and they are responsible for addressing any privacy issues involved in the request. The individual bureaus also handle direct requests for information. They too are responsible for following the privacy policy as applicable. Any information released to the media from individual bureaus gets recorded via a computer form that is filled out and sent to the Public Information Officer. Policies regarding access to information retrieved from databases within the NH Department of Environmental Services (DES) are published on the DES website (http://www.nh.gov/disclaimer.html#policy).

Each bureau or program within DES is responsible for implementing monitoring systems that are needed to carry out its duties as set forth in the applicable statutes and rules. Several of the established monitoring programs utilize both staff resources and volunteer monitors. In many instances, monitoring activities are coordinated at the division level. The majority of groups performing monitoring have in-house IT support and either have already developed information systems to manage the data or have requested assistance with such systems. In some cases the groups do not have IT support and have built their own systems, and in other cases groups have contracted out or receive contractor support through EPA. Agency-wide there is a major effort underway to expand the Environmental Monitoring Database over time to serve as a single repository for all water quality, air quality, drinking water, soil contamination and other monitoring data.

The hardware platform(s) used by DES include: Compaq/HP servers for file/ print, AD, WEB, FileNet, Alpha server for Oracle, Dell workstations for desktop. The operating system(s) include: MS 2000 Serving 4 locations, 9x/2000/NT/XP for desktop OS. Database(s) include: Oracle, Visual FoxPro, SQL, and Access. The DES network (see Figure 1) uses WAN servers for four locations and currently uses Frame technology, but is moving to DSL. The email server is MS Exchange 2000. All of DES network runs on the TCP/IP protocol. This is maintained by the state Office of Information Technology, which has segmented our network so that only DES employees see DES computers. DES network is not accessible directly from outside clients. DES uses NHSUN, which has a built in firewall to keep out unauthorized access. Ironmail automatically scans emails to remove unsolicited email (SPAM). Network anti virus software scans all computers connected to the DES network, and port protection assures that only certain computers are allowed access from outside DES.

Figure 1: NH DES Infrastructure Overview



VII. The Administration and Operation of the NH DHHS Network

IT Standards and Specifications are the responsibility of the Office of Information Technology (NH-OIT). In conjunction with the Department of Health and Human Services, appropriate technologies and solutions are factored into the creation of data repositories containing sensitive information. For example, if the data requires isolation then physical as well as software solutions are implemented with the appropriate levels of security, monitoring and validation of the users. The State of NH is primarily a Microsoft 2000 and 2003 environment, employing a wide range of software and physical safeguards to restrict and protect access to data. Secure Socket Layer (SSL) certificates and connections using 128-bit encryption are often required. In addition, joint panels that include representatives of OIT, the division responsible for the program and users, periodically review policies and practices. Several levels of authorization are required to grant access to data sources. This practice ensures that unauthorized access is not given inadvertently. When data sets involve multiple agencies or organizations, the elements of the data sets are reviewed and the requirements for access and analysis are critically assessed by OIT and the agencies involved. If the data sets are deemed to contain information not relevant to the datum required, a specific sub-set of attributes and elements are created and stored in a separate repository following the granting and access policies described above.

With respect to data acquisition and transfer, information can be accessed and transferred via TCP/IP and/or secure FTP depending on the nature and sourcing of the data. The State of NH requires that all access external to the state be drive through secure firewalls. At times, even intranet access may require be granted access through a firewall in addition to other security and administration structures that are in place.

In the coming year, the State of NH will be implementing the base NEDSS system for surveillance, analysis and tracking. Based on this initiative, local control and access to surveillance data will be greatly enhanced. Today, a significant portion of the data exchange and access is based on secure FTP of requisite information.

With respect to systems managed by the State of NH or outside agencies the governing principles for administration, assess, and oversight are the same. Externally maintained systems have administrative rights granted to state personnel for the purposes described throughout this section. When systems are established at a contractor's site or via an ASP (Alternate Service Provider) model, the contractor is monitored by OIT and the project administrator assigned to the program from DHHS. All policies and practices to be adhered to are explicitly defined in the scope of work (SOW) and the contract. All programs are structured to be absorbed into the operational environment of the state if the contract has been terminated for cause or for economic or program consideration.

VIII. Surveillance Databases Software Development Capacity

A. NH Department of Environmental Services (DES)

NH DES carries out a variety of monitoring activities to measure pollution levels and compliance with DES rules. The department directly maintains and operates air quality monitoring stations with automated data loggers that send data directly to certain computers at DES. Air emissions monitoring is primarily done by the facilities that then report the data to DES on a regular basis according to regulatory requirements. DES staff also does periodic emissions monitoring with mobile equipment. Ambient water quality monitoring data is primarily collected by staff using mobile equipment and then entering results in the Environmental Monitoring Database back in the office. There is also some use of automated data loggers for water quality; this data ultimately also ends up in the EMD. Drinking water monitoring is the responsibility of the facilities and, like air emissions data, is reported regularly to DES. Consultants under contract for site cleanups usually do monitoring of contaminated waste sites, which can include air, water and/or soil monitoring. The results are reported to DES in a range of formats, although the plan is to have these results submitted to the EMD.

B. NH Department of Health and Human Services (DHHS)

NH DHHS reports on many different types of health concerns within NH for its citizens and visitors. DHHS is tasked with the collection, storage, analyzing and dissemination of NH health-related data, including births, deaths, hospitalization, cancer and behavioral risk factors. These surveillance systems are set up by DHHS to better assess the burden of disease and injury in NH. DHHS analyzes information from reported marriages and divorce records and from reported records of new cancer cases and distributes statistical reports to government agencies and other public and private organizations that request them. The data is also used to plan, administer and evaluate DHHS and other programs. DHHS receives the cancer data set electronically from the NH State Cancer Registry (NHSCR). NHSCR currently collects reports from hospital registrars operating an all the large hospitals in NH. This information contains personal information on cancer patients including their age, sex, race, ethnicity and residence and information on the patient's primary tumor and treatment including the date of diagnosis, detection, clinical extent and staging.

IX. Current Sources of Support for Surveillance and Related IT

A. NH Department of Environmental Services (DES)

Currently much of the environmental monitoring and the reporting and analysis of results is mandated by the federal government and is paid for with federal grant dollars. The EPA Exchange Network Grant Program funds are a primary source of funds for improving the information systems used to manage and report this monitoring data. For example, currently DES has a pilot project that is focused on electronically receiving sampling data from both the state laboratory and private laboratories. This information will be received into the DES data warehouse. Currently there are hundreds of thousands of sampling results contained within the warehouse. From this warehouse, management systems are being developed to inform decision makers at all levels of different issues going on based on the results of the monitoring. This project is funded through the Exchange Network Grant Program as a multi-state effort.

B. NH Department of Health and Human Services (DHHS)

Disease reporting in New Hampshire is supported by both state and federal funds dedicated to surveillance activities and have a stable source of revenue. Birth and Death data have mandated reporting requirements (RSA 5C) through the NH Bureau of Vital Statistics located in the NH Secretary of State's Office. State appropriations and fees on birth and death certificates support the funding stream for Vital Records data since the early 1900s. Hospitalization data are collected via a mandated reporting process (RSA 126) supported by State law and funded via appropriations through the legislature and in-kind labor from the NH Hospital Association. The NH State Cancer Registry has collected data via mandated reporting since 1998 (RSA 141), and is supported by a combination of state and federal funds. In order to better manage large data sets, DHHS has developed a health data warehouse that acts as a storage and standardization location for birth, death and hospitalization data. The NH EHT Program has gained access to both Vital Records, Hospitalization and Cancer Registry data sources, and is exploring the ability to access the data warehouse.

Improvements to the NH health data collection system are being proposed as part of the PHIN/NEDSS health information technology process. DHHS is currently soliciting bids for a contractor to manage the standardization of state health records based on CDC guidance for information technology.

X. Interaction Between State and Local Public Health Departments' Surveillance and Environmental Monitoring Information Databases

A. NH Department of Environmental Services (DES)

There has been limited contact to date between DES IT personnel and local officials. When there are projects that involve localities, the contact is usually through the particular bureau that initiated the project. However, currently the DES IT group is involved with a multi-state homeland security grant, which will enable the flow of certain environmental information directly to homeland security officials at all levels of government, and in all likelihood there will be direct interaction with local health and environmental officials throughout this project.

B. NH Department of Health and Human Services (DHHS)

Within the State of NH, there are multiple health departments (i.e., Manchester Public Health, Nashua Public Health, etc.). Local IT departments often mirror the state's practices and infrastructures in many ways. Strict adherence to security, privacy, analysis, and release are the cornerstone principles of each organization. While the structures of the organizations that formulate and enforce practices and policies vary from those established at the State, the net result is the same. The differences in schema employed reflect the structure and size of the organizations not the philosophy or adherence to applicable laws and statutes.

For additional information regarding local IT infrastructure, contact the following agencies:
Manchester Health Department, (603) 624-6466, www.manchesternh.gov/CityGov/HLT/Home.html
Nashua Public Health Department, (603) 594-3355, www.gonashua.com

XI. Conclusion

This in-depth inventory of health and environmental databases in New Hampshire has provided the first comprehensive picture of the available data for our three priority areas of 1) air quality-asthma, 2) radon-lung cancer, and 3) arsenic-bladder/skin cancer. The information systems discussed here represent a changing and evolving network of environmental health data, information technology, and the technical staff that support its use. As a result, this inventory will need to be published to the web and updated on a periodic basis. Database inventories such as this are an essential first step toward the development of new or expanded surveillance efforts. We encourage public planners, database managers, researchers and other interested parties to read this report with an eye on how to understand, use and improve these databases.

Key discoveries that were revealed by the inventory process include the large number of environmental and health databases in New Hampshire, the limited number of past inventory efforts, and clear gaps in the availability of certain data sources. For our limited focus on only three areas of concern (air quality-asthma, radon-lung cancer and arsenic-bladder/skin cancer), we identified at least two-dozen potential data sources and interviewed sixteen database stewards in order to document the contents and purpose of these information systems. We had hoped that past inventories conducted by public health or environmental agencies would help us identify additional data sources, but few examples of relevant projects were found. As a result, we revealed the need for an inventory system that can be searched by keywords in order to discover existing data sets, and we plan to approach the UNH Health Data Inventory to explore the feasibility of adding relevant environmental or public health data sets to their web-based system (http://www.nhhealthdata.org/). In addition, the discovery of important data gaps in the areas of air quality hazards, smoking status, radon mitigation status, arsenic hazards, and data access policies will provide the basis for our future environmental health data acquisition plan.

Key lessons learned that might inform other data inventory processes include the necessity of a human perspective on our current information technology, a clearer understanding of disease risk factors, and the difference between an inventory and a database evaluation process. In regard to human resources, although this report is called a ‘data base inventory’, it could easily have been described as an inventory of ‘data stewards’ to reflect the importance of the staff members who maintain these systems. Unfortunately, data stewards change every few years, often leaving data users

with an information-rich electronic database existing within a human knowledge-poor system. The people who manage these systems on a daily basis are the best resources for understanding why the databases work as they do, and their strengths or limitations in use for environmental health research. The exercise of breaking down each priority area into it's multiple risk factors was an important lesson that lead to our decision to expand the inventory project scope and include additional databases. As an example, by understanding that the primary risk factors for asthma causation are often indoor pollutants (dust mites, pet dander, etc.), we were able to better assess the availability of databases for indoor allergens. In addition, we learned that a full inventory of existing databases does not necessarily reveal the quality of the data in each system. A further evaluation of surveillance data will need to be completed in the future to determine the system's flexibility, timeliness, and accuracy.

In summary, this database inventory has helped the NH Environmental Health Tracking Program to understand the process of developing a standards-based, coordinated, and integrated environmental health tracking system. The purpose of the system will be to undertake the ongoing monitoring, reporting, linkage, and communication of data on environmental hazards, toxic exposures, and environmentally-related diseases in order to improve the public health of New Hampshire citizens. The next steps in our assessment process will be to integrate this database inventory with the other building blocks of the tracking system, distribute the results to our stakeholders, and continue to update the inventory to take into account new information resources, and work on public policy that will ensure expanded access to high quality data.

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